HYDROGEL FORMED BY ORGANOGELATOR THROUGH SURFACTANT-MEDIATED GELATION (SMG) METHOD

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Low molecular weight gelators (LMGs) can easily form a gel through a simple dissolution and cooling process in a solvent. In such gels, the LMG molecules form self-assembled fibrillar networks (SAFiNs) which arrest the solvent. An example of an LMG is the organogelator 12-hydroxyoctadecanoic acid (12-HOA) which gels various organic solvents but not water. However, it is possible that hydrogels can be produced by dissolving 12-HOA in an aqueous surfactant solution due to the solubilization capacity of surfactant self-assemblies such as micelles. We refer this novel approach as the surfactant-mediated gelation (SMG) which allows "hydrogelation by organogelator" without any chemical treatment on the gelator molecule.

A clear transparent solution was obtained when 12-hydroxyoctadecanoic acid (12-HOA) was solubilized in an aqueous micellar solution of cationic surfactants such as cetyltrimethylammonium bromide (CTAB) at 80°C. Then the sample was gradually cooled to room temperature and a gel was obtained. [1] Minimum gelation concentration and viscoelasticity was influenced by the hydrophobic chain length and the kind of counter ion as well as the micellar shape. 12-HOA was also added to lamellar liquid crystal formed by didodecyldimethylammonium bromide (DDAB) and the same treatment was carried out to obtain a gel. [2] Dynamic viscoelasticity measurements showed that the gelled samples have a higher storage modulus (*G*') and loss modulus (*G*") than the non-gelled samples, indicating that SAFiNs of 12-HOA improve the mechanical properties of the sample. Transmission electron microscopy (TEM) and small- and wide-angle X-ray scattering (SWAXS) measurement on the gels revealed the formation of 12-HOA gel fiber which is the same fibers formed in organogels. SAXS, small angle neutron scattering (SANS) and UV-Vis measurements suggest the coexistence of the gelator fibers and the surfactant aggregates, indicating the hydrogels prepared by the SMG method are orthogonal self-assembled systems. This feature lends itself to applications as functional soft matters.

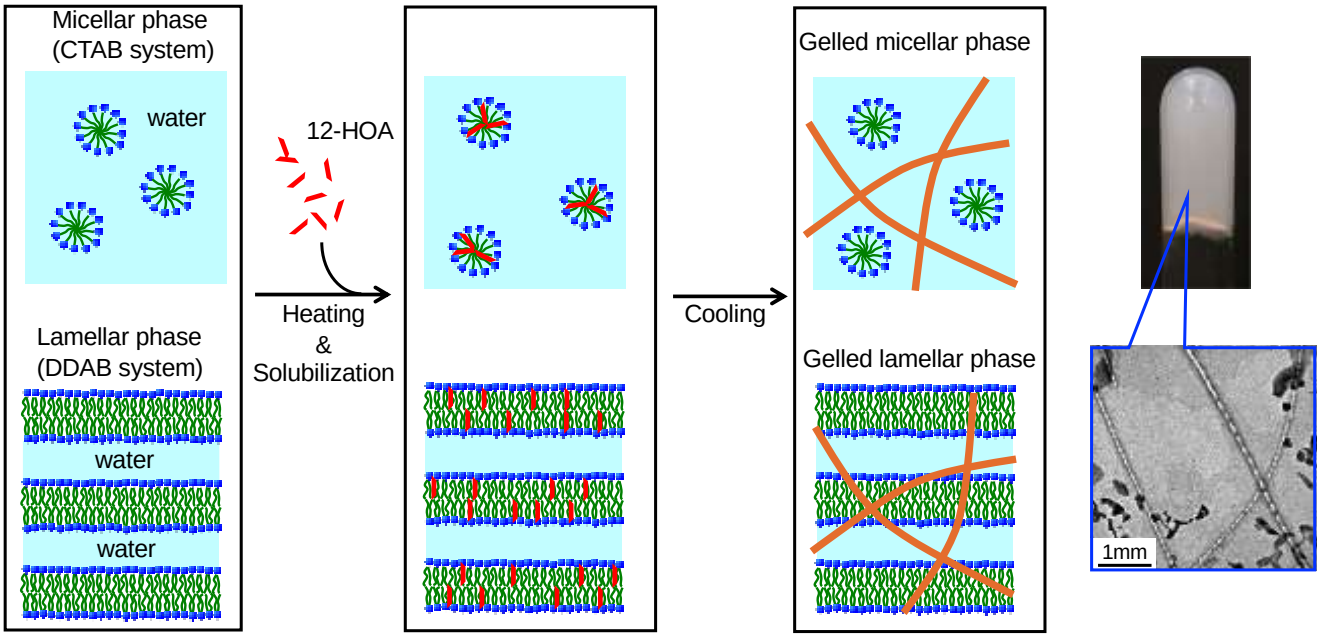

Figure 1 – Preparation of hydrogels through "Surfactant Mediated Gelation (SMG)"

[1] K. Aramaki, S. Koitani, E. Takimoto, M. Kondo, C. Stubenrauch, under review.
[2] S. Koitani, S. Dieterich, N. Preisig, K. Aramaki and C. Stubenrauch, *Langmuir*, 2017, 33, 12171.